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EXERCISES.

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If

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 & \dots & h_1 \\ a_2 & b_2 & c_2 & \dots & h_2 \\ a_3 & b_3 & c_3 & \dots & h_3 \\ \dots & \dots & \dots & \dots & \dots \\ a_n & b_n & c_n & \dots & h_n \end{vmatrix}, \text{ and } D = \begin{vmatrix} \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} & \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} & \dots & \begin{vmatrix} a_1 & h_1 \\ a_2 & h_2 \end{vmatrix} \\ \begin{vmatrix} a_1 & b_1 \\ a_3 & b_3 \end{vmatrix} & \begin{vmatrix} a_1 & c_1 \\ a_3 & c_3 \end{vmatrix} & \dots & \begin{vmatrix} a_1 & h_1 \\ a_3 & h_3 \end{vmatrix} \\ \dots & \dots & \dots & \dots \\ \begin{vmatrix} a_1 & b_1 \\ a_n & b_n \end{vmatrix} & \begin{vmatrix} a_1 & c_1 \\ a_n & c_n \end{vmatrix} & \dots & \begin{vmatrix} a_1 & h_1 \\ a_n & h_n \end{vmatrix} \end{vmatrix};$$

then will

$$D = a_1^{n-2} \Delta. \quad [T. M. Blakslee.]$$

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Prove geometrically or by circular co-ordinates (or in any other way), that if the sides of a triangle of given shape pass through fixed points,

1. Any line connected with the moving triangle passes through a fixed point;
2. Any connected circle envelopes a nodal bicircular quartic;
3. All such quartics have a common node.

[Frank Morley.]

273*

The asymptotes of a curve all meet at P . Show that P is the mean centre of the feet of the normals from it to the curve.

[Frank Morley.]

274

At what point on the surface of a sphere will an observer see the reflection of a distant light?

[L. G. Carpenter.]

275

Investigate a formula for the shortening of the day at a place of latitude φ by a chain of mountains of angular altitude h and azimuth A .

[L. G. Carpenter.]

276

Show that the attraction of a finite mass on one of its points is finite.

[A. Hall.]

*See a magnificent paper by Humbert, *Journal de Math.*, 4th series, tome iii, pp. 327-404, where by a novel use of Abel's Theorem one's ideas on the properties of algebraic plane curves receive a decided generalization. The above exercise is a special variation on a theme there given (p. 362).

FIG. 1.

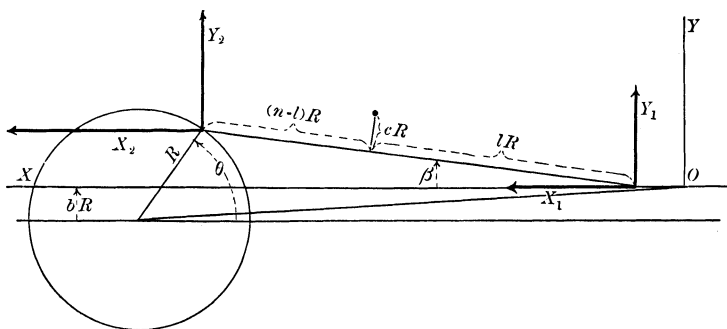


FIG. 2.

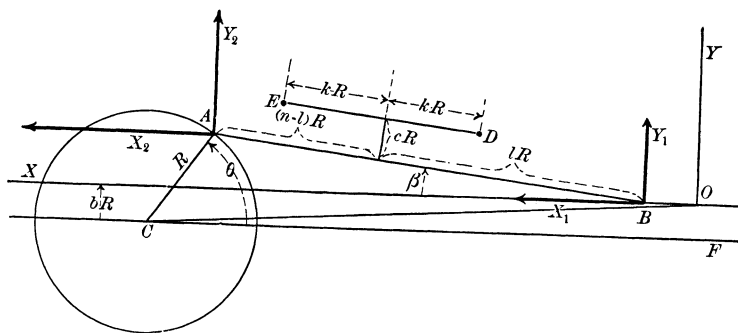


FIG. 3.

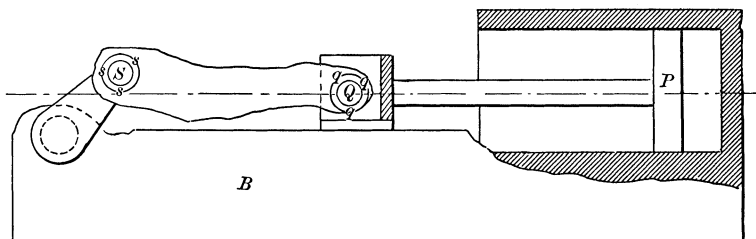


FIG. 4.

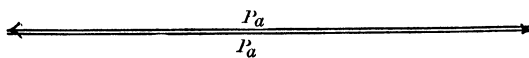


FIG. 5.

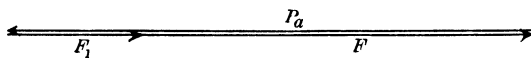


FIG. 6.

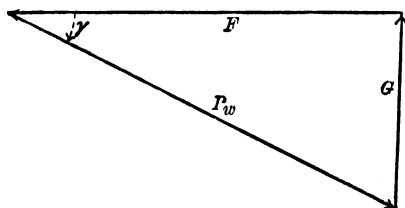


FIG. 7.

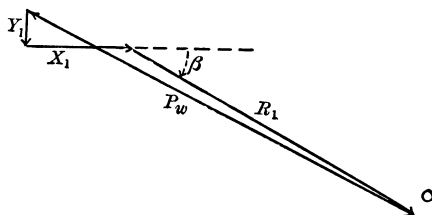


FIG. 8.

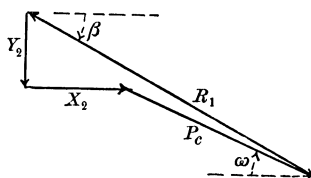


FIG. 9.

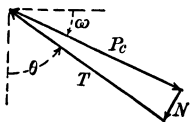


FIG. 10.

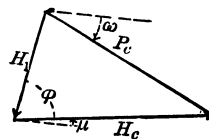


FIG. 11.

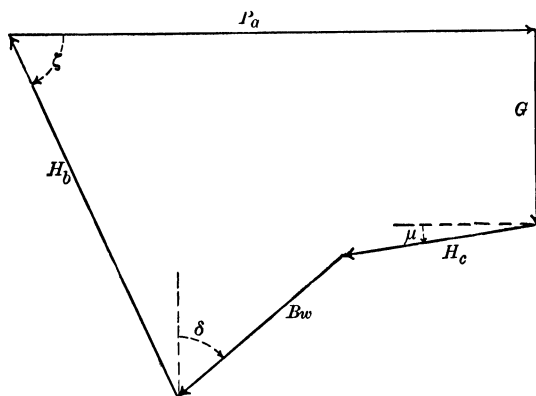


FIG. 12.

